Climate's Long-term Impacts on Metro Boston *(CLIMB)*

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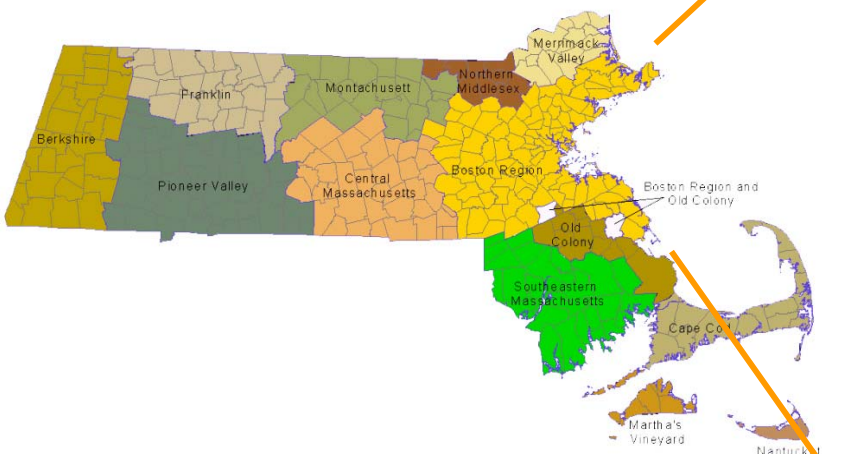
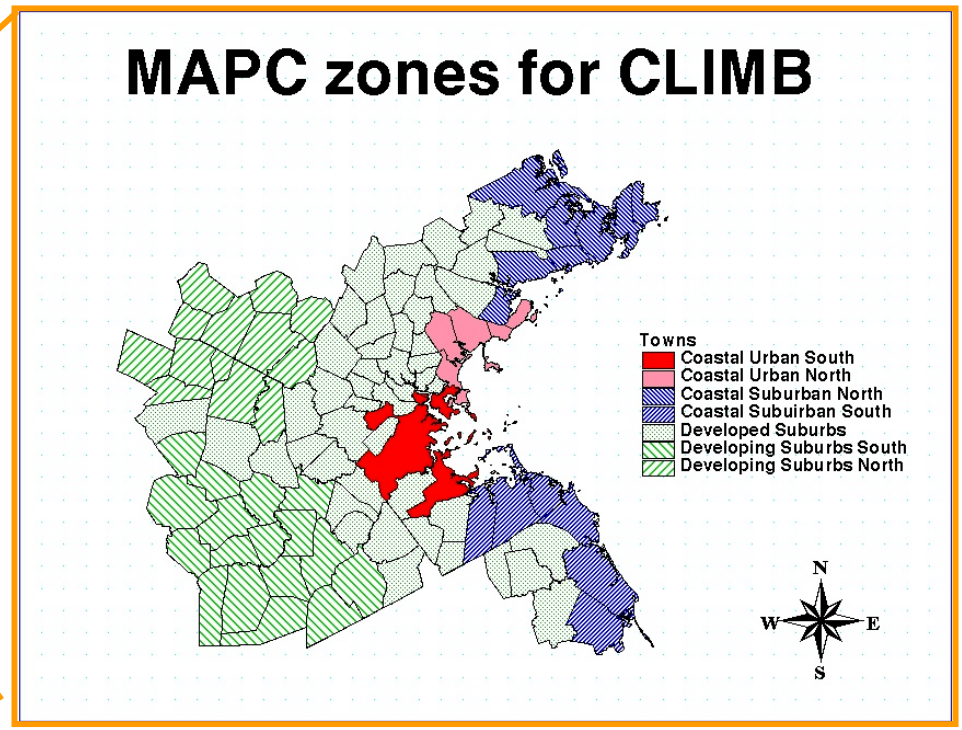
University of Maryland

Climate Change and Urban Infrastructure

- Climate's Long-term Impacts on Metro Boston *(CLIMB)*
  - Study Region
  - Structure
  - Methodology
  - Applications and Findings
- Six Challenges for Research and Policy

Metro Boston



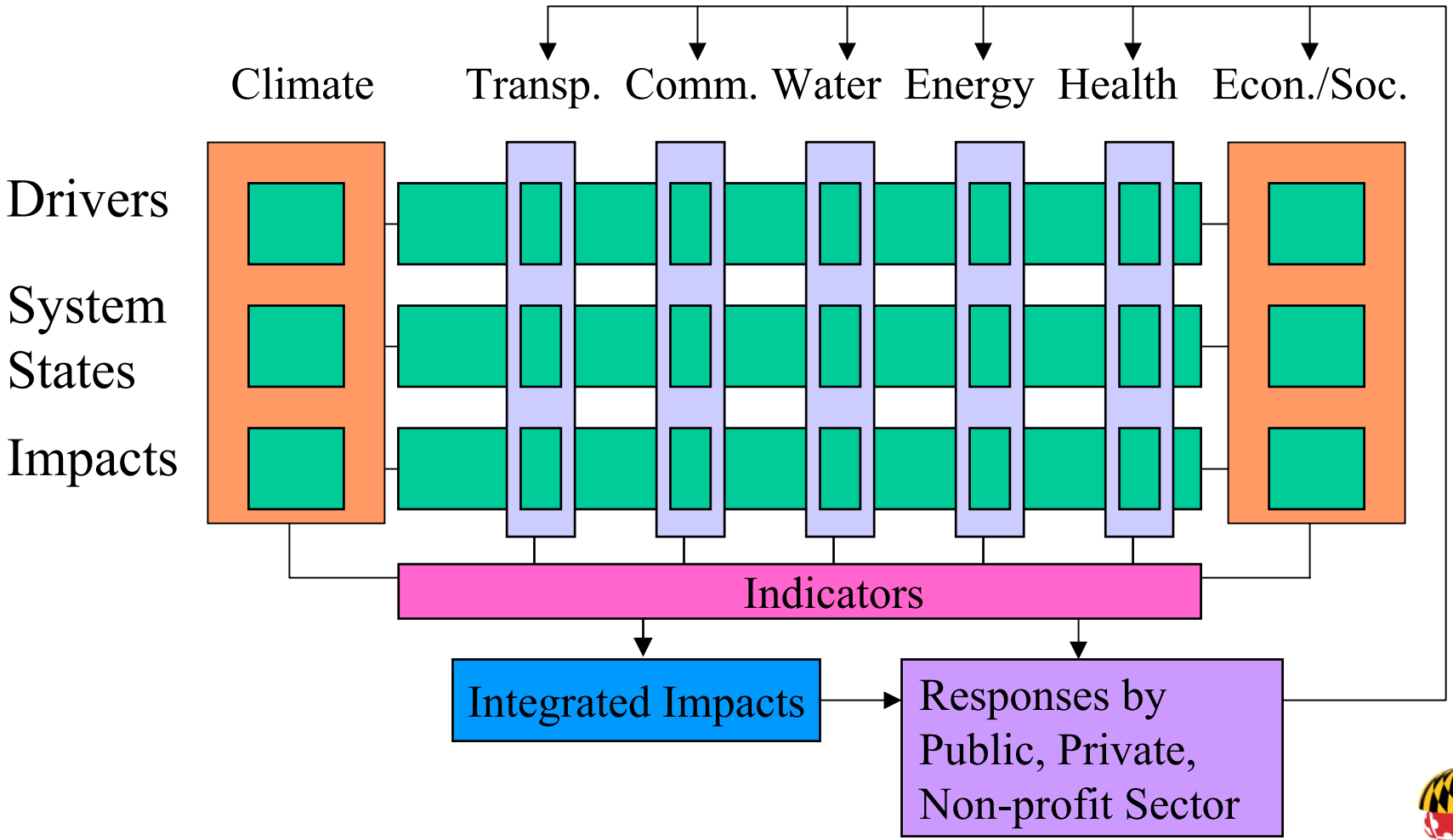


CLIMB

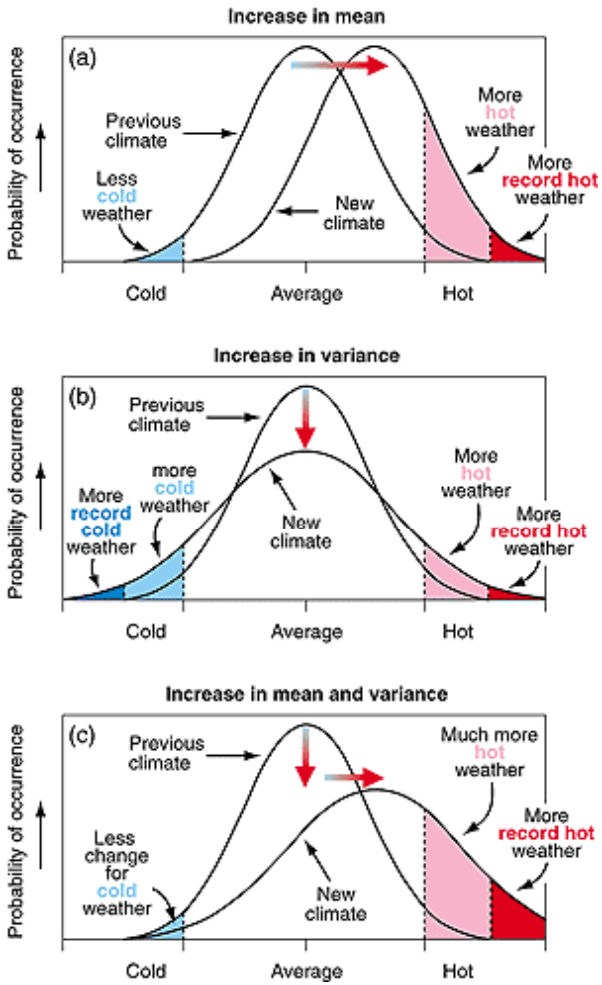
– Project Structure –

CLIMB

– *Information Management, Modeling, and Scenario Development* –



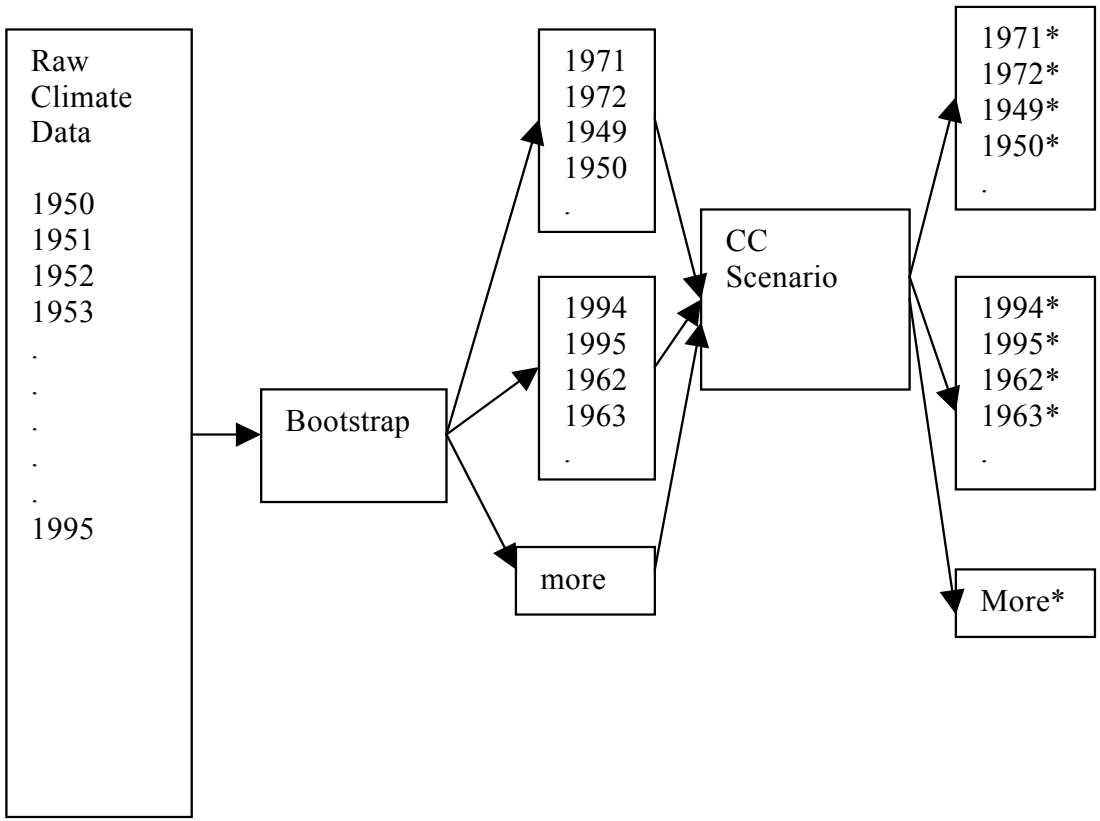
Changes in Temperature Mean and Variance



(Source: IPCC 2001)

Bootstrapping

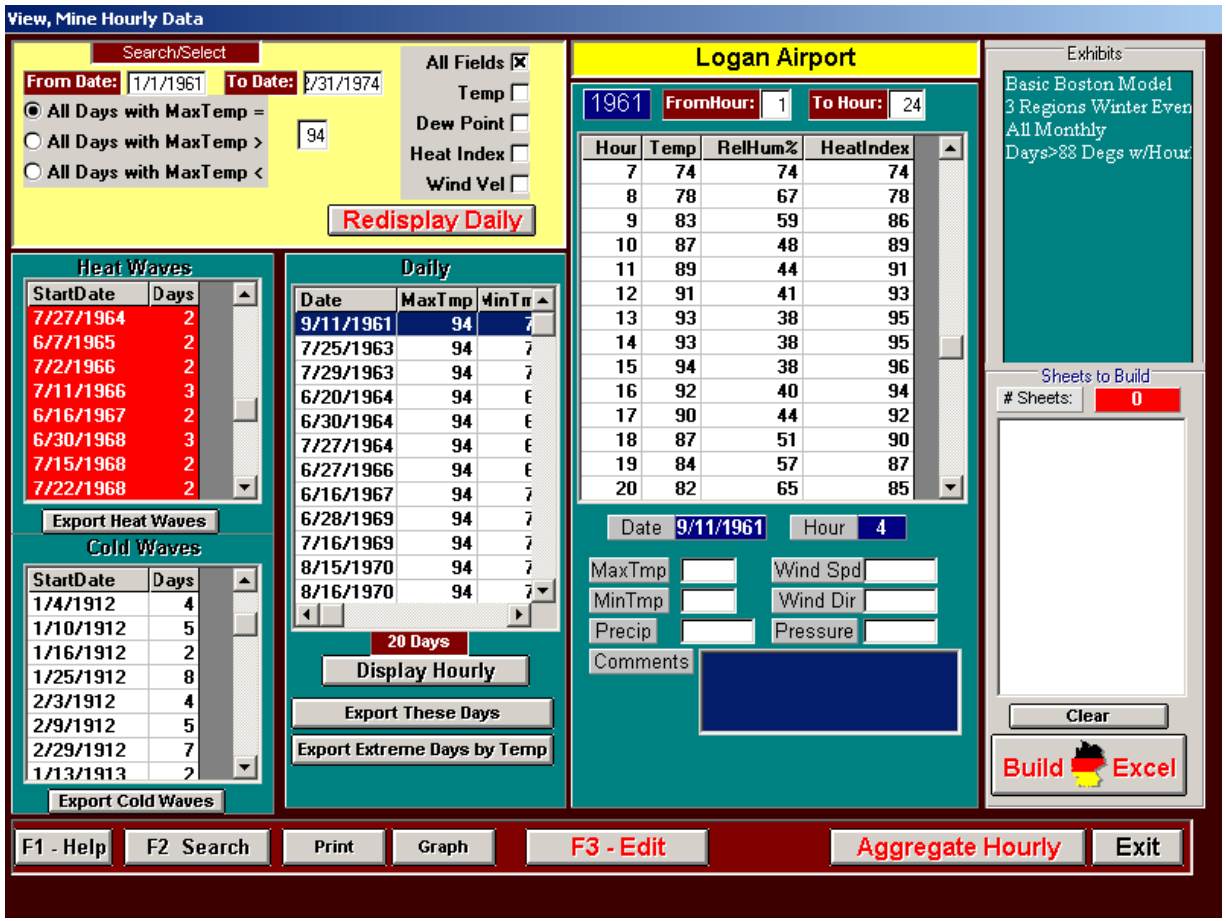
Bootstrapping Process to Generate Climate Time Series



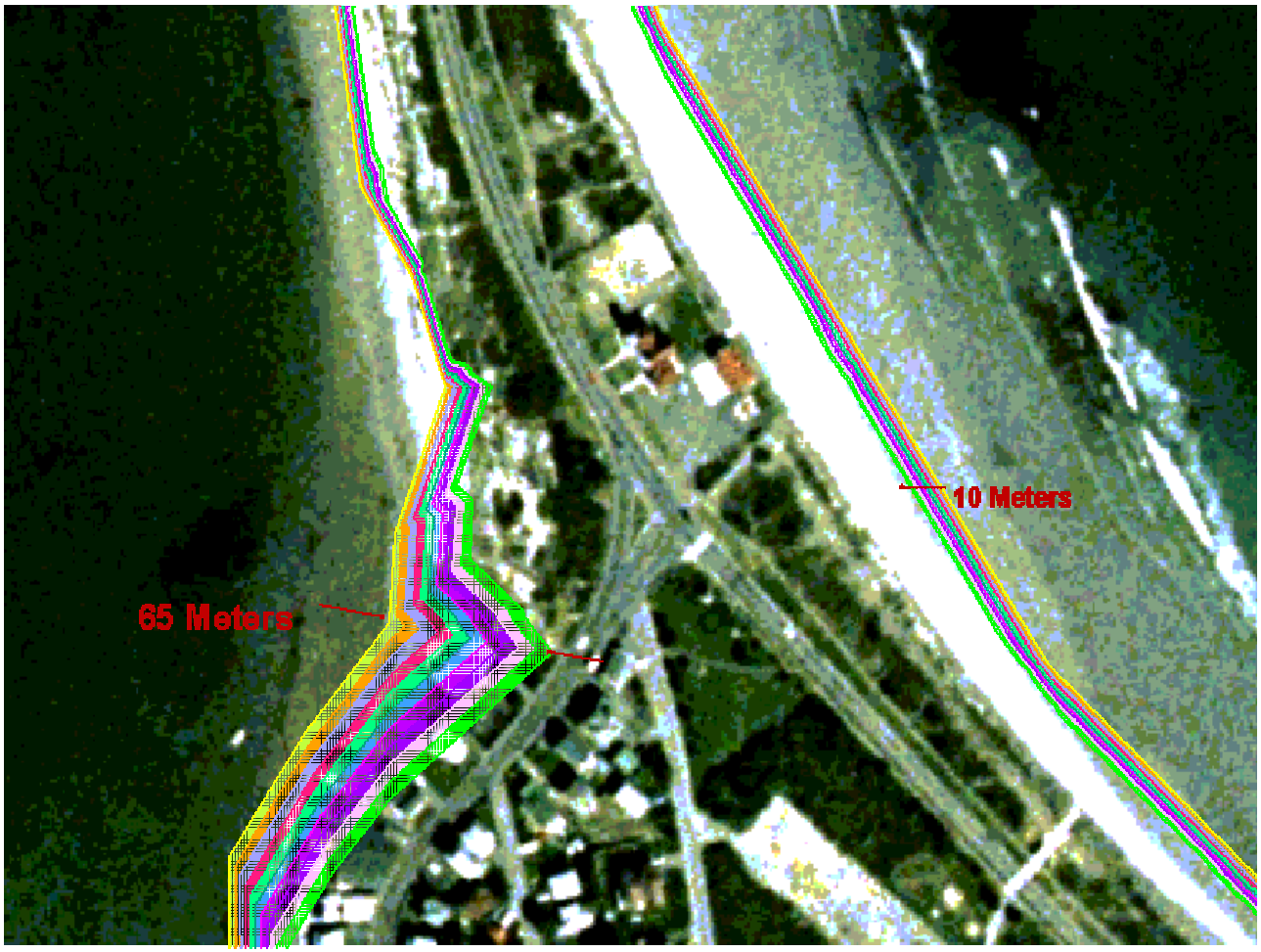
Climate Data Software

Climate Data Software

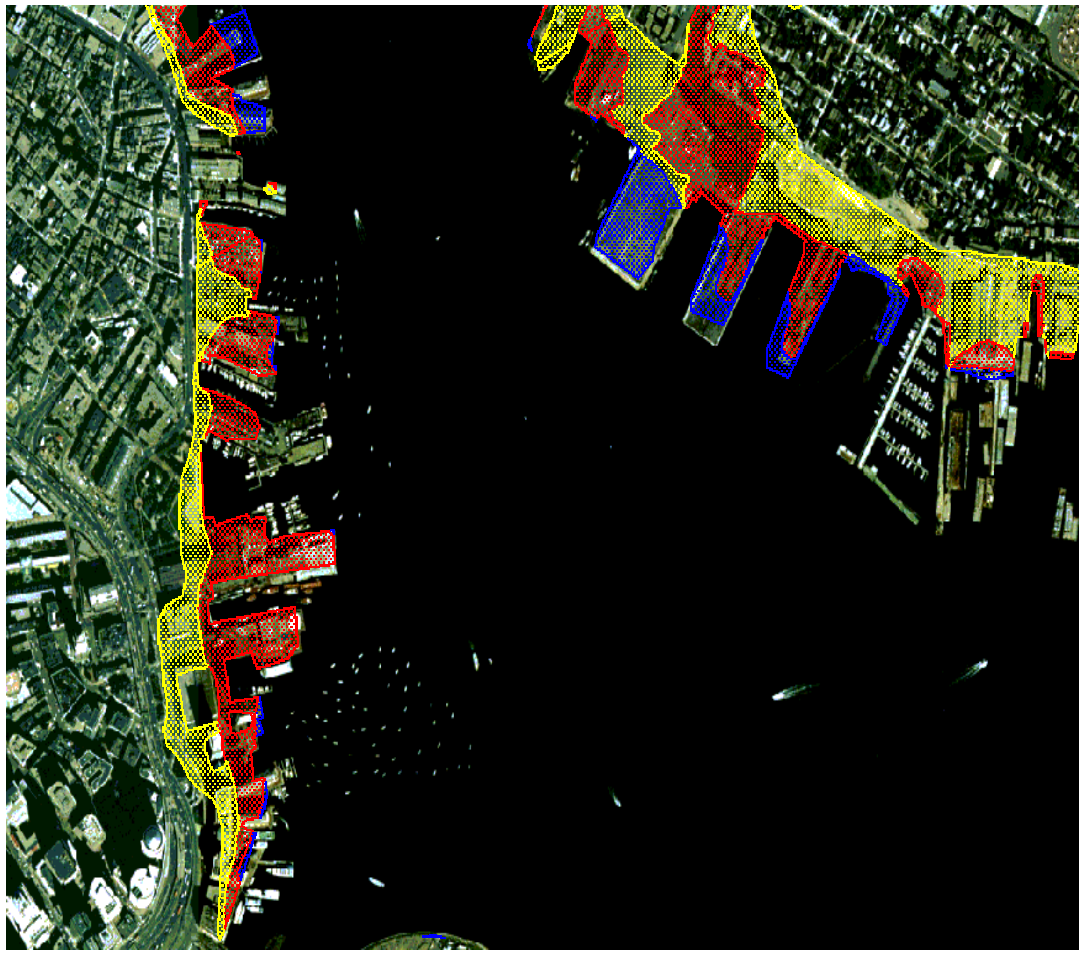
– Daily to Hourly Drill Down –



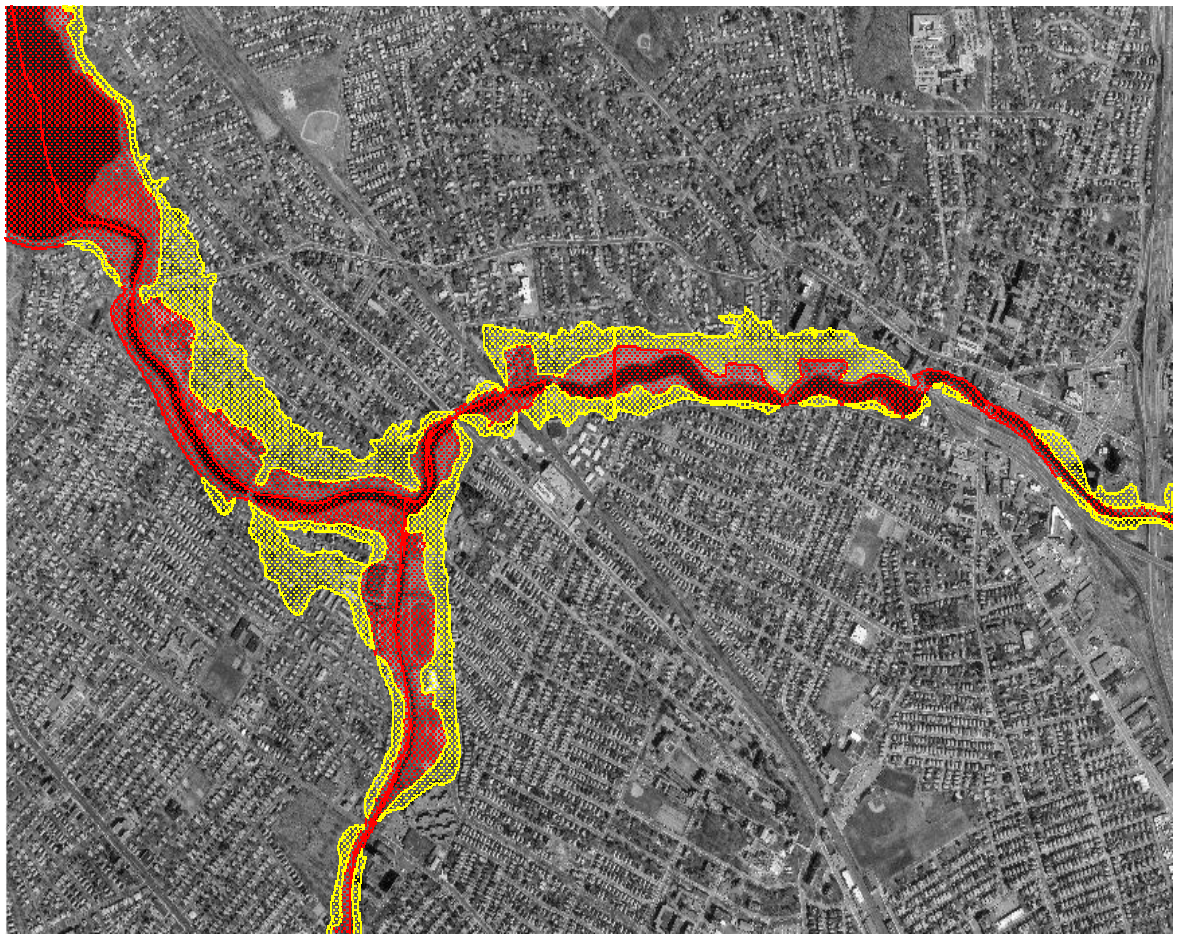
Sea Level Rise Illustration for Nahant



Sea Level Rise
Boston Harbor



Storm Surges



Scenarios

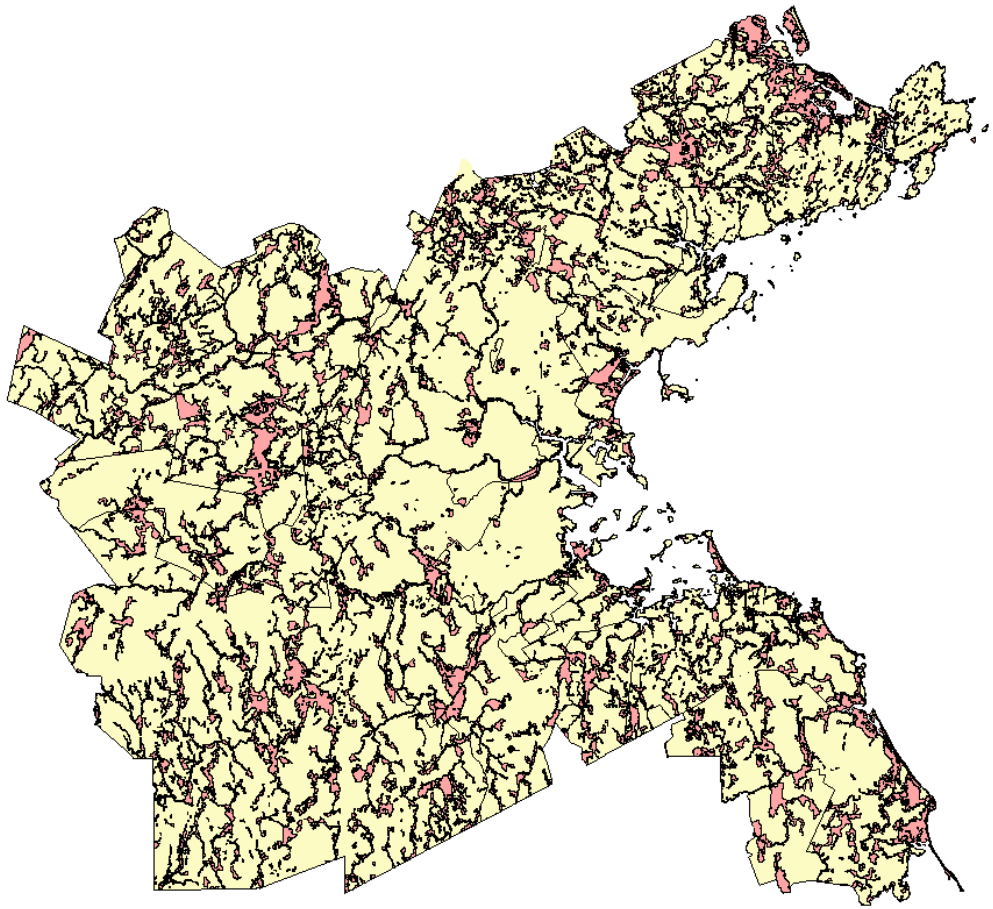
Title	Policy	Demographic	Economic	Technology
"Ride It Out"	Present trends in region continue. There are no adaptation actions. Current subsidies for automobiles continue.	Same as current MAPC scenario of continued sprawl, low population growth rate, major growth at fringes and outside of region.	Same employment by sector as current MAPC scenarios.	Low rate of penetration of green and innovative technology by sector.
"Green"	Restrictions on construction locations. Stronger bldg codes. Renewable energy. More mass transit. Natural hazard zoning. No more sea walls except for major commercial areas. Emphasis on more centralized development.	Same population growth as "Ride It Out" but more centralized in line with policy scenario.	Same as above.	Higher rate of green technology penetration than "Ride It Out".
"Build Way Out"	Same as "Ride It Out" but replace and protect systems as they fail.	Same as "Ride It Out"	Same as "Ride It Out"	Same as "Ride It Out"

Storm Surge Flooding

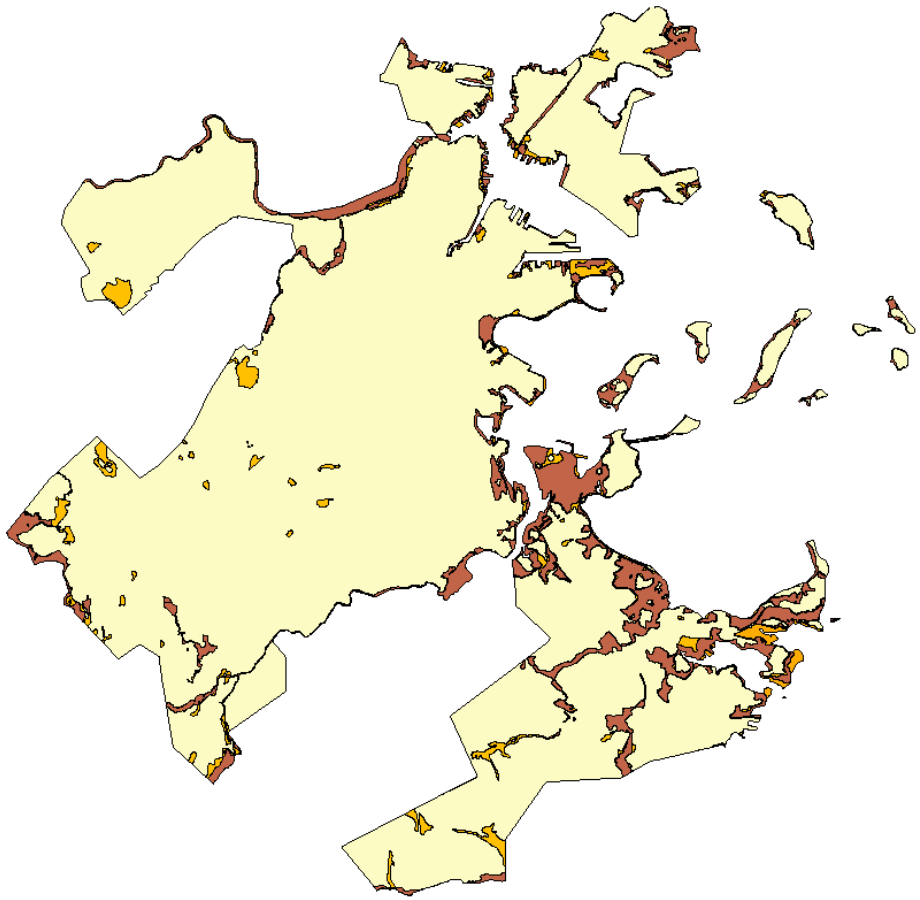
Scenario	Cummulative Damage (mil of $ over 100 years)	Cummulative Land at Risk (Res, Comm, Ind Hectares)
Continue Present Conditions	593.3	4,597.3
RIO - CCC Climate Scenario, MAPC Population Scenario	2,419.2	18,955.8
Green - CCC Climate, no development, no reoccuring damages	86.3	672.9
BYWO	Length of Protection (km)	Wetlands At Risk (Hectares)
Existing Walls	553.1	805.5
New Walls	579.8	2110.1
Projected	in progress	in progress

Transportation

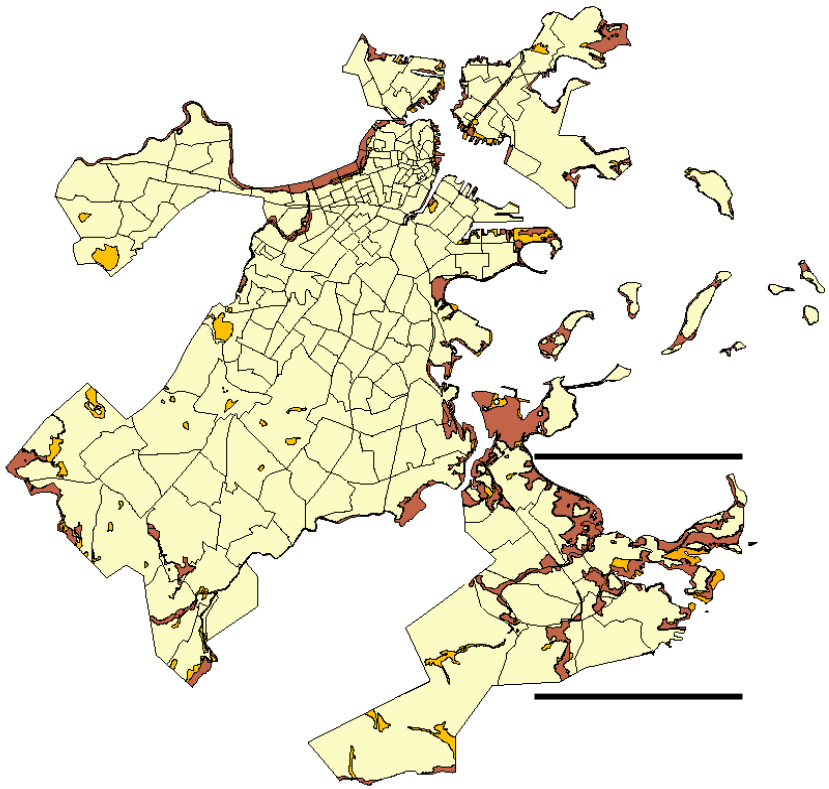
FEMA Flood Map for CLIMB Region

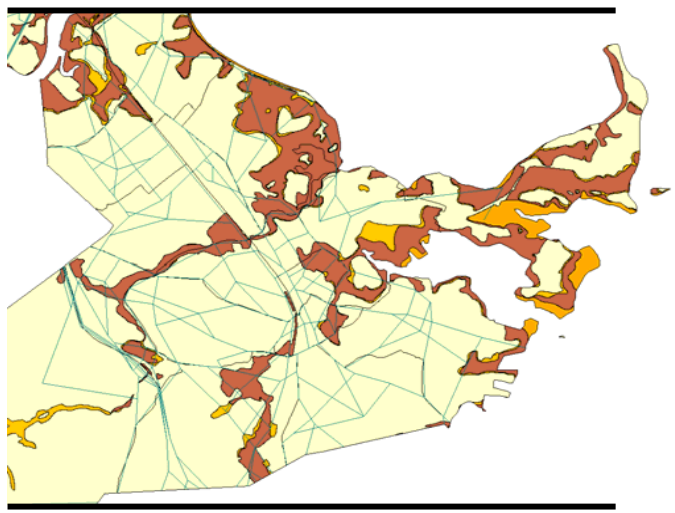


Transportation
Flood Plains in Region 1

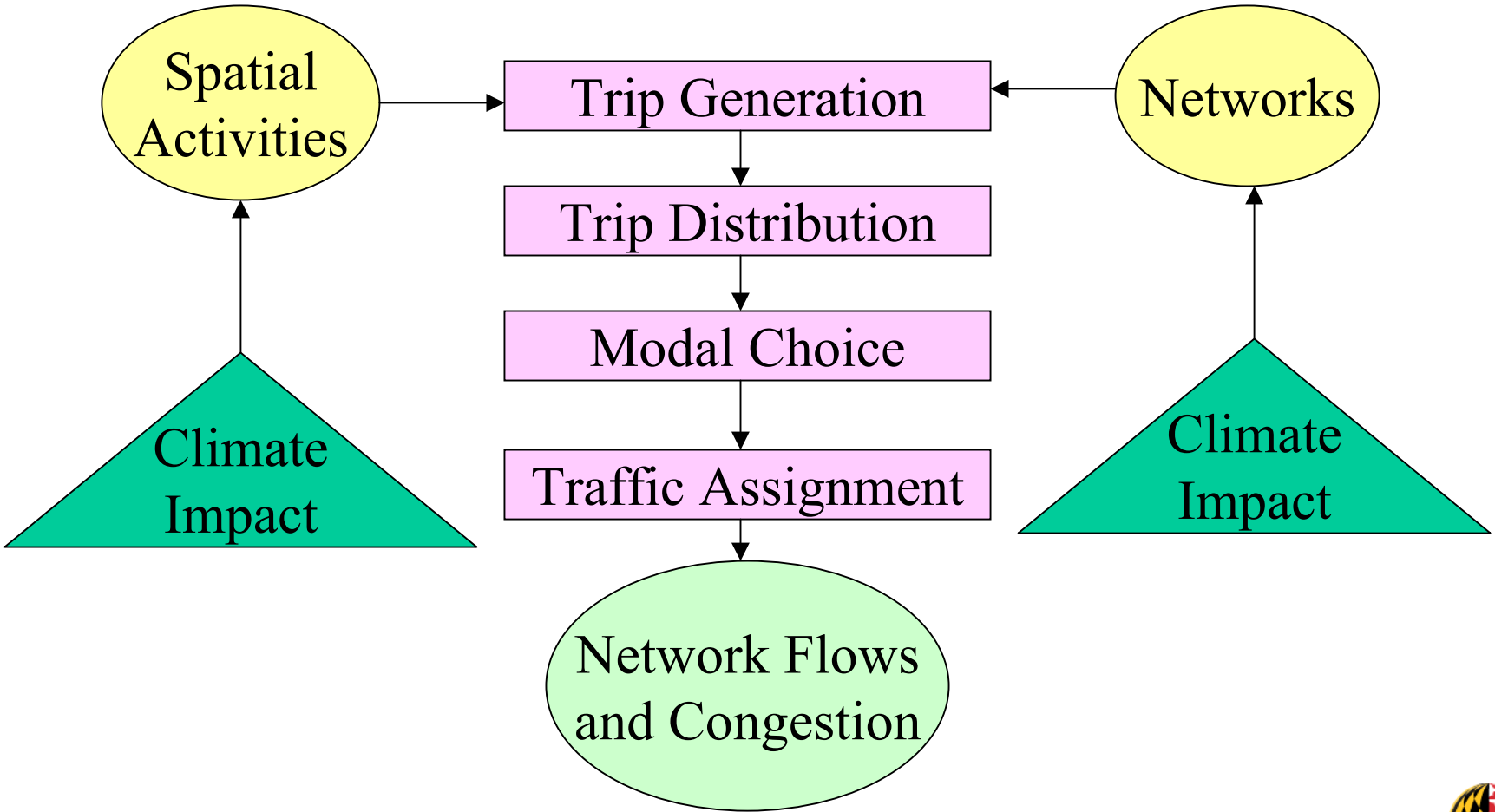


Transportation
Overlay of Traffic Analysis Zones





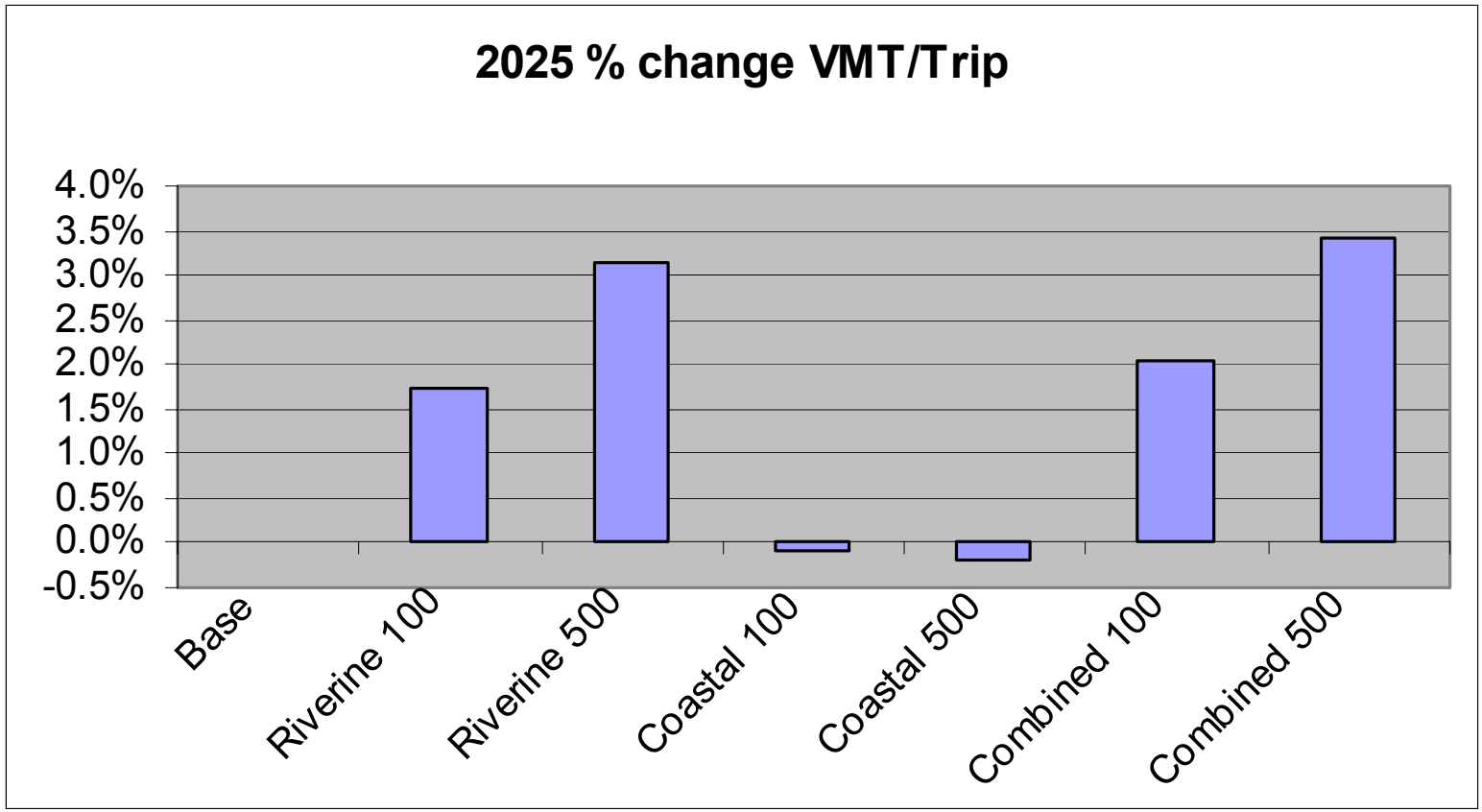
Transportation



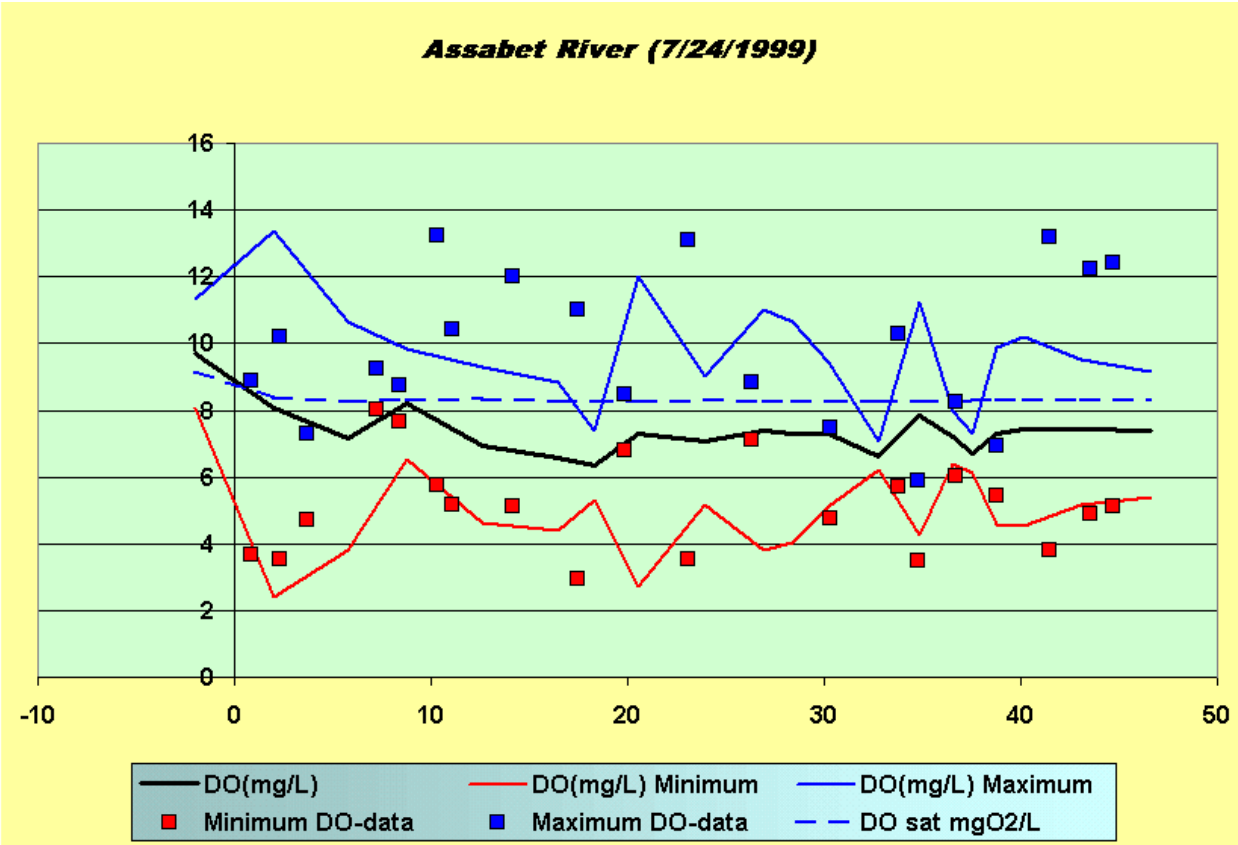
Transportation
Scenario Results

2025 Model Results	Base	Riverine Flooding		Coastal Flooding		Combined	
		100 Year	500 Year	100 Year	500 Year	100 Year	500 Year
		change	change	change	change	change	change
Links Deleted	0	445	673	196	236	641	908
Travel Impacts							
Total Trips	16,454,769	-96,905	-164,576	-165,272	-184,876	-193,440	-224,945
VMT	158,717,552	1,824,400	3,358,688	-1,711,168	-2,079,520	1,321,200	3,177,536
VHT	4,562,397	197,655	346,581	-43,712	-53,685	206,561	380,685
Avg. Speed	34.79	-1.06	-1.77	-0.04	-0.05	-1.23	-2.04

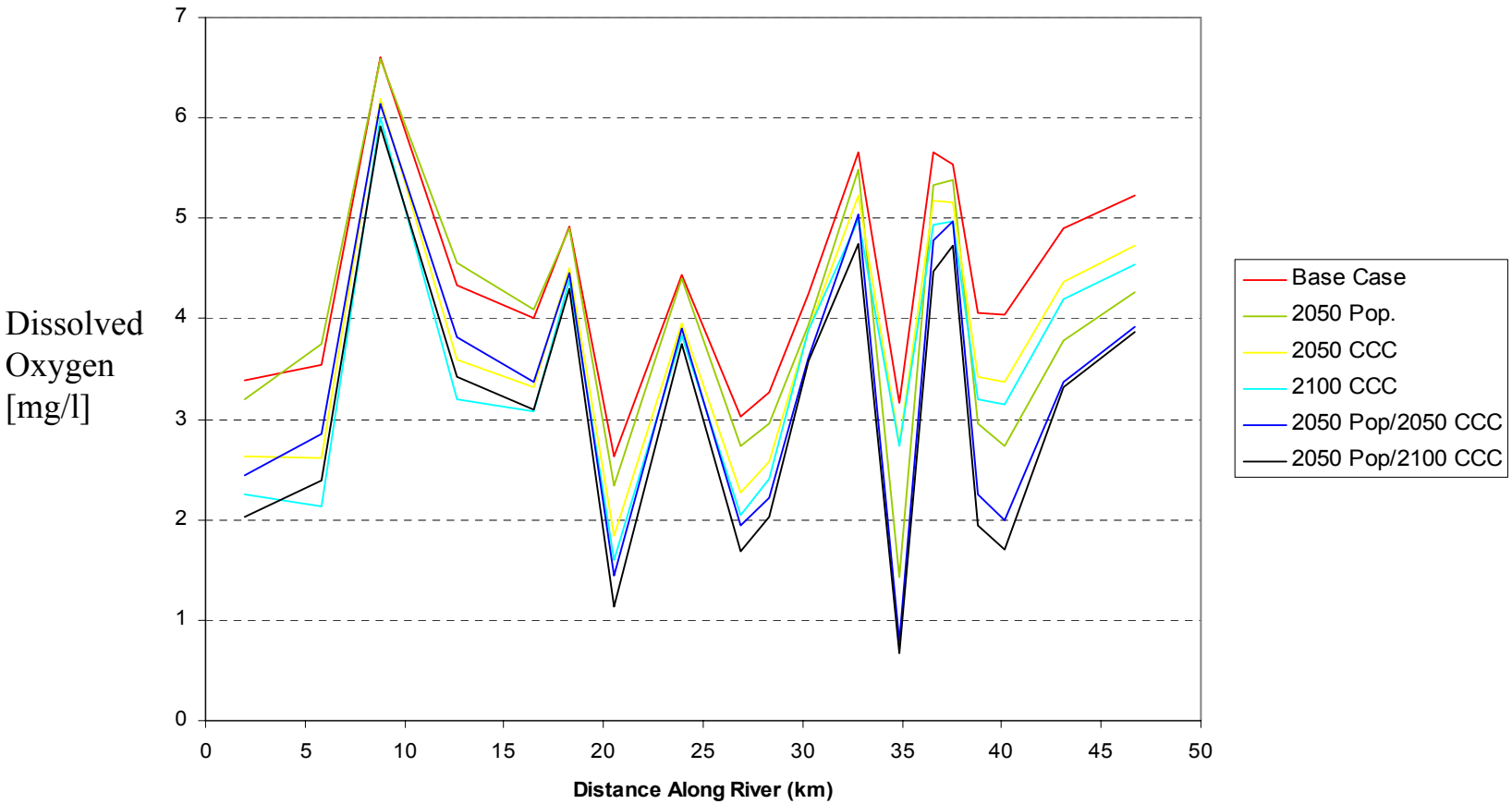
Transportation
Scenario Results



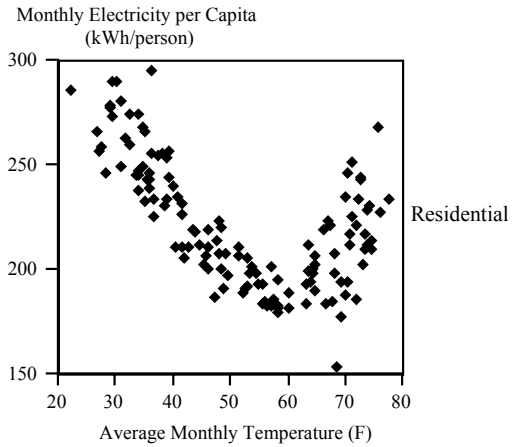
Water Quality Simulations for Assabet River

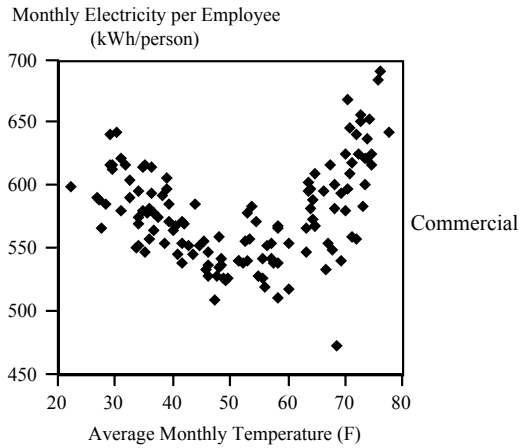


Model Results for Various Scenarios

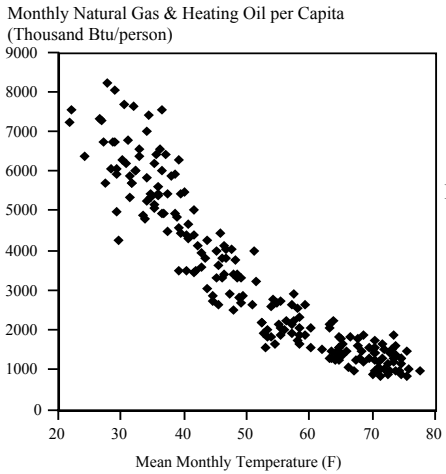


Average Monthly Temperature and Electricity Consumption

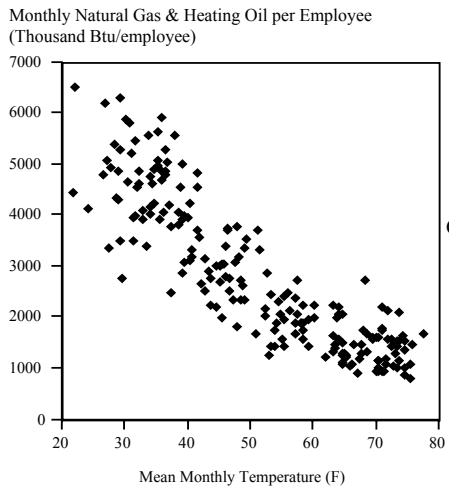




Average Monthly Temperature and Heating Fuels Consumption



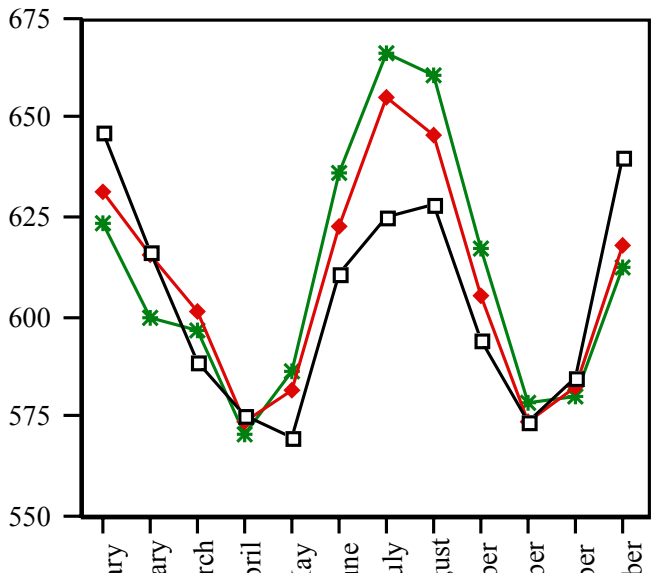
Residential



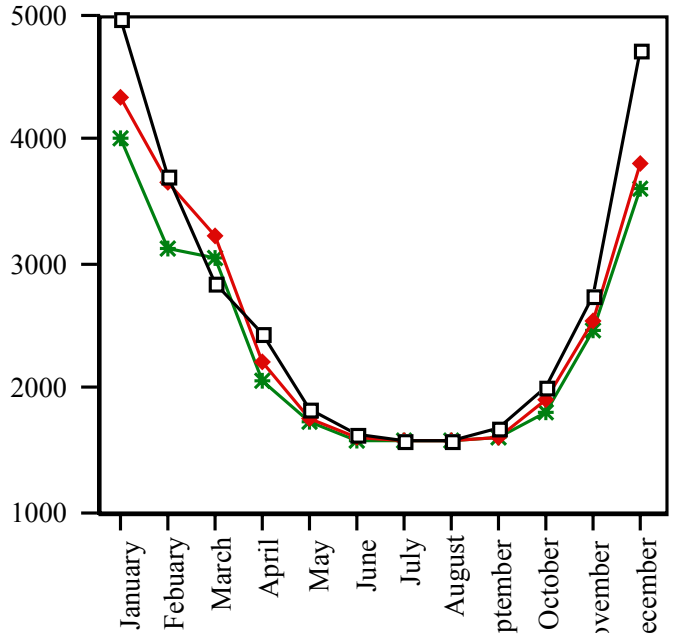
Commercial

Residential Electricity and Heating Fuel Use

Electricity per Employee
(kWh/employee/month)



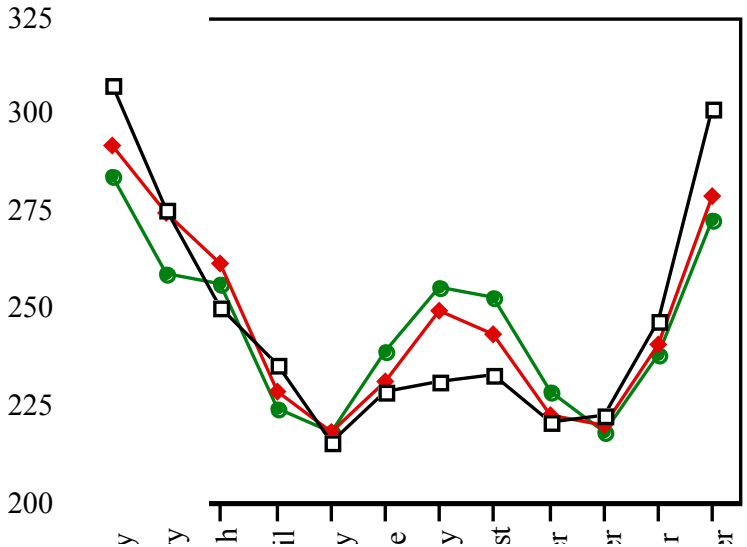
Heating Fuels per Employee
(1000 btu/employee/month)



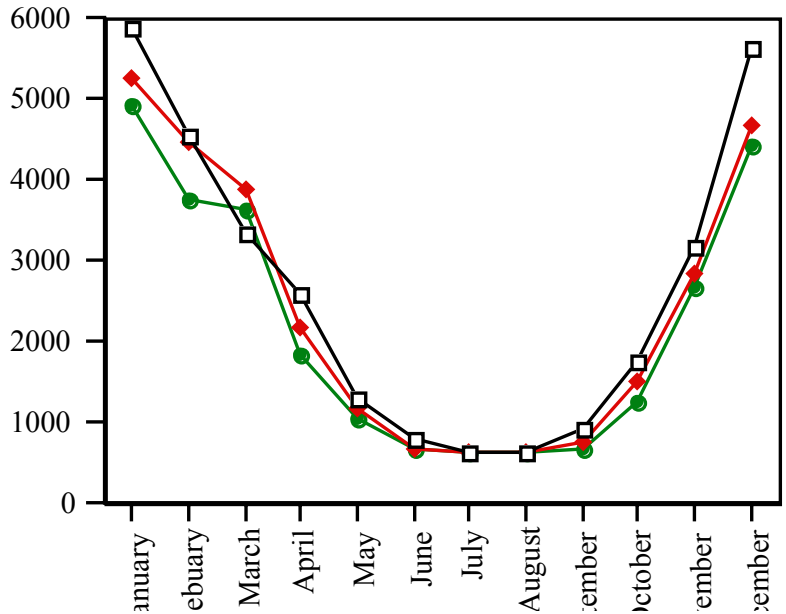
2000 2020 2050

Commercial Electricity and Heating Fuel Use

Electricity per Capita
(kWh/person/month)



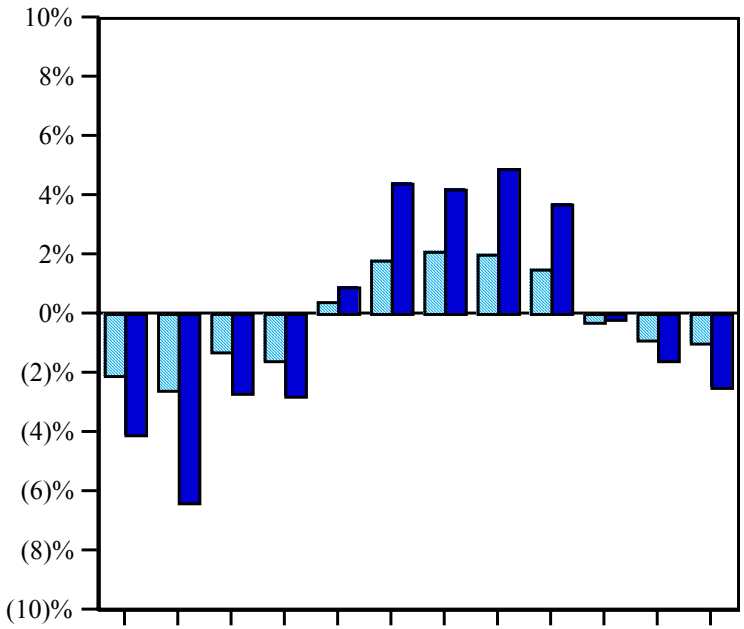
Heating Fuels per Capita
(1000 btu/person/month)



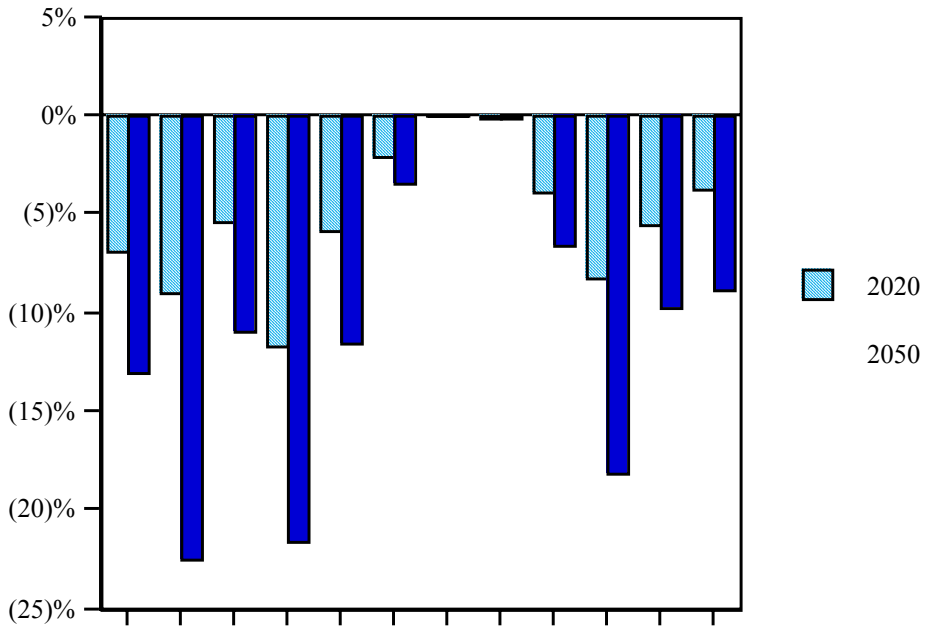
2000 2020 2050

Changes in Electricity and Heating Fuel Uses

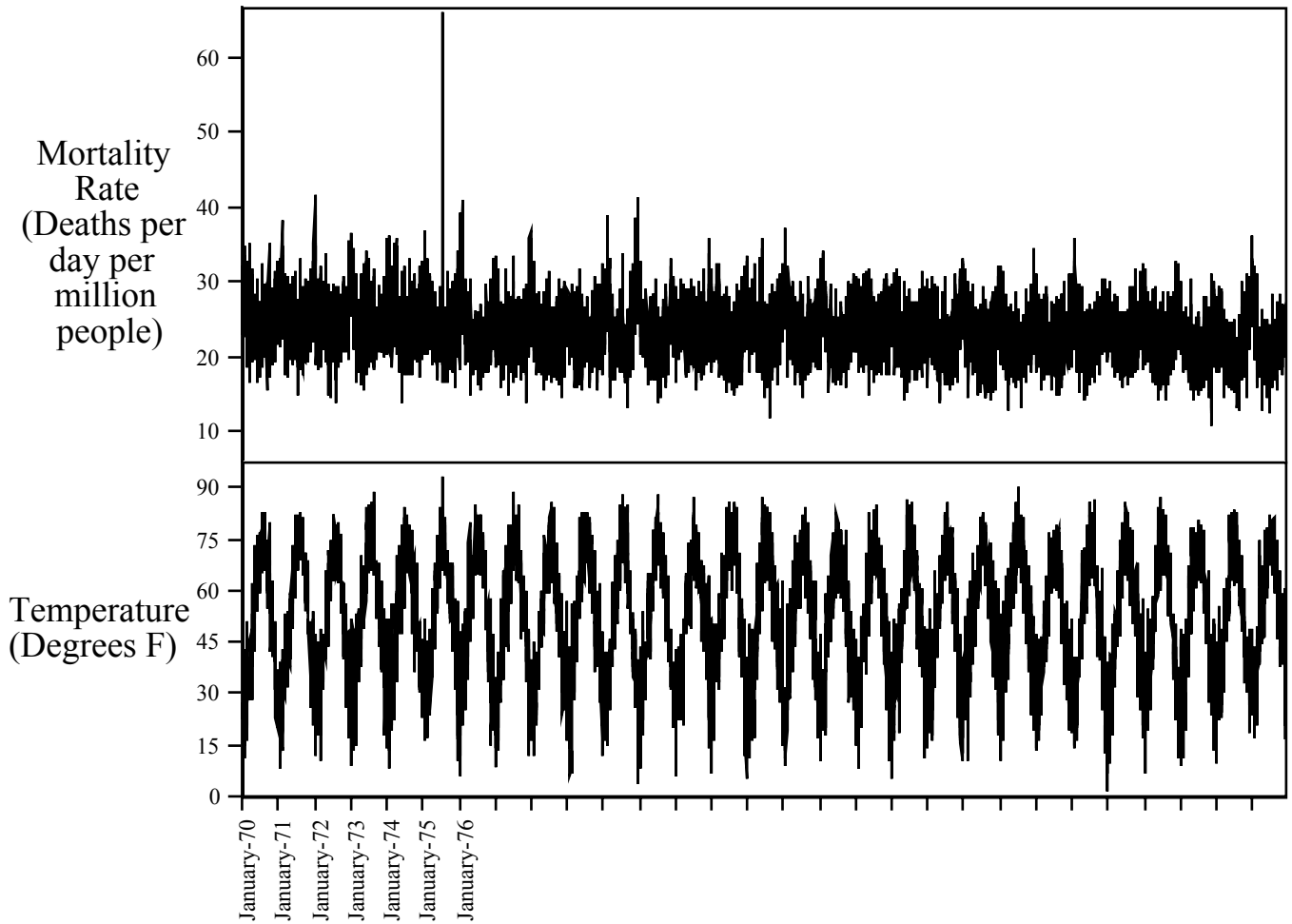
Change in Electricity Use



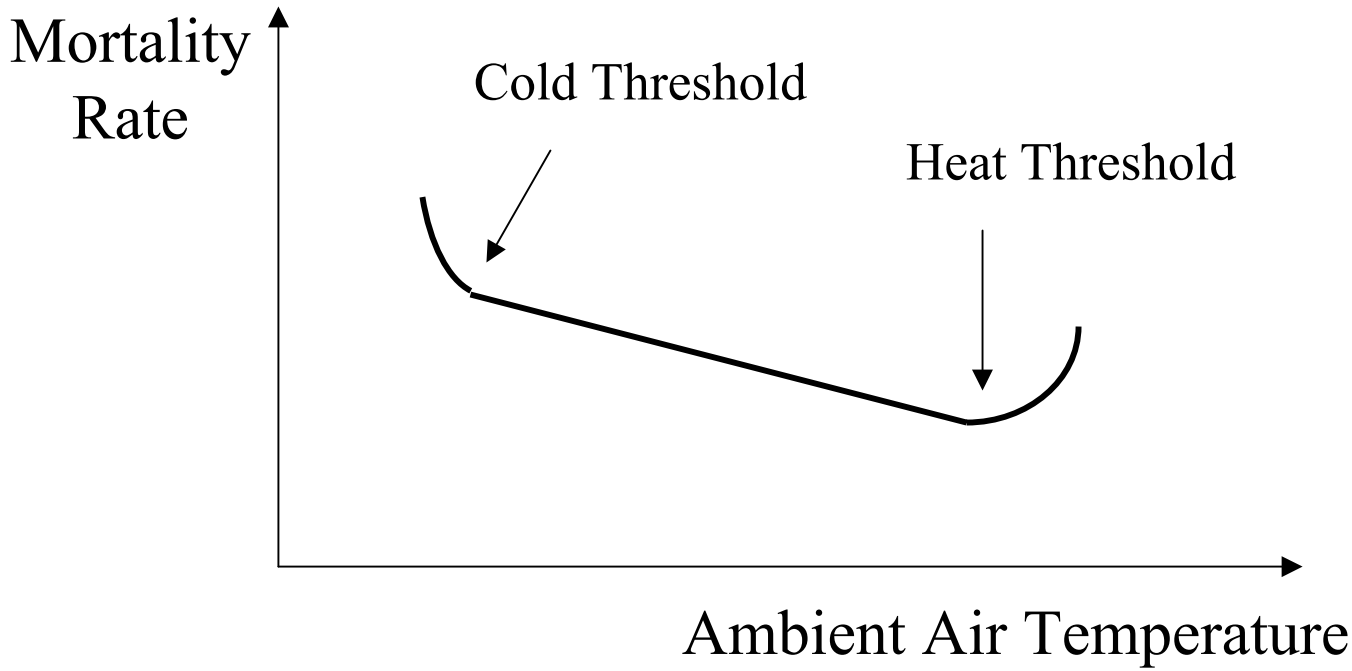
Change in Heating Fuel Use



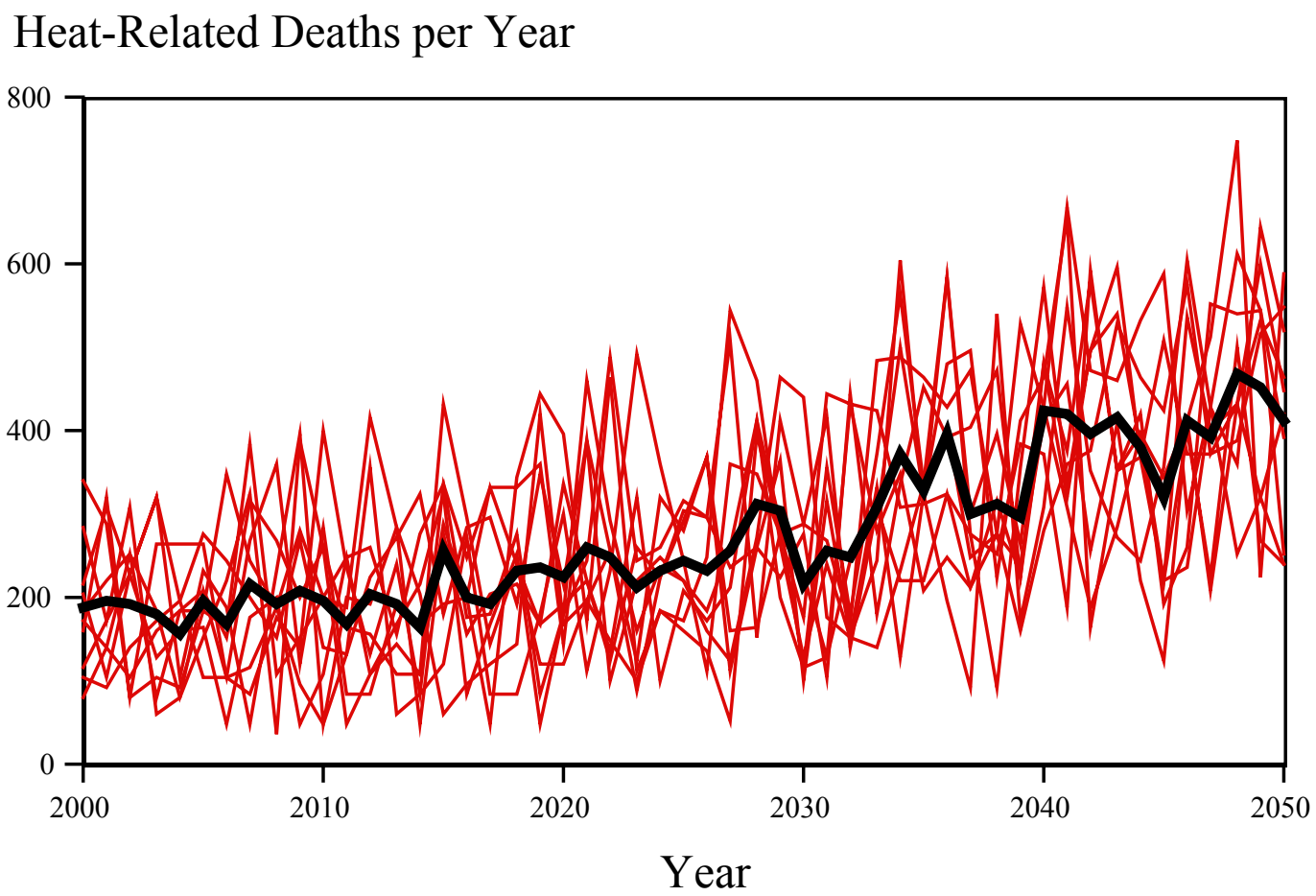
CLIMB Regional Daily Mortality Rate and Average Temperature



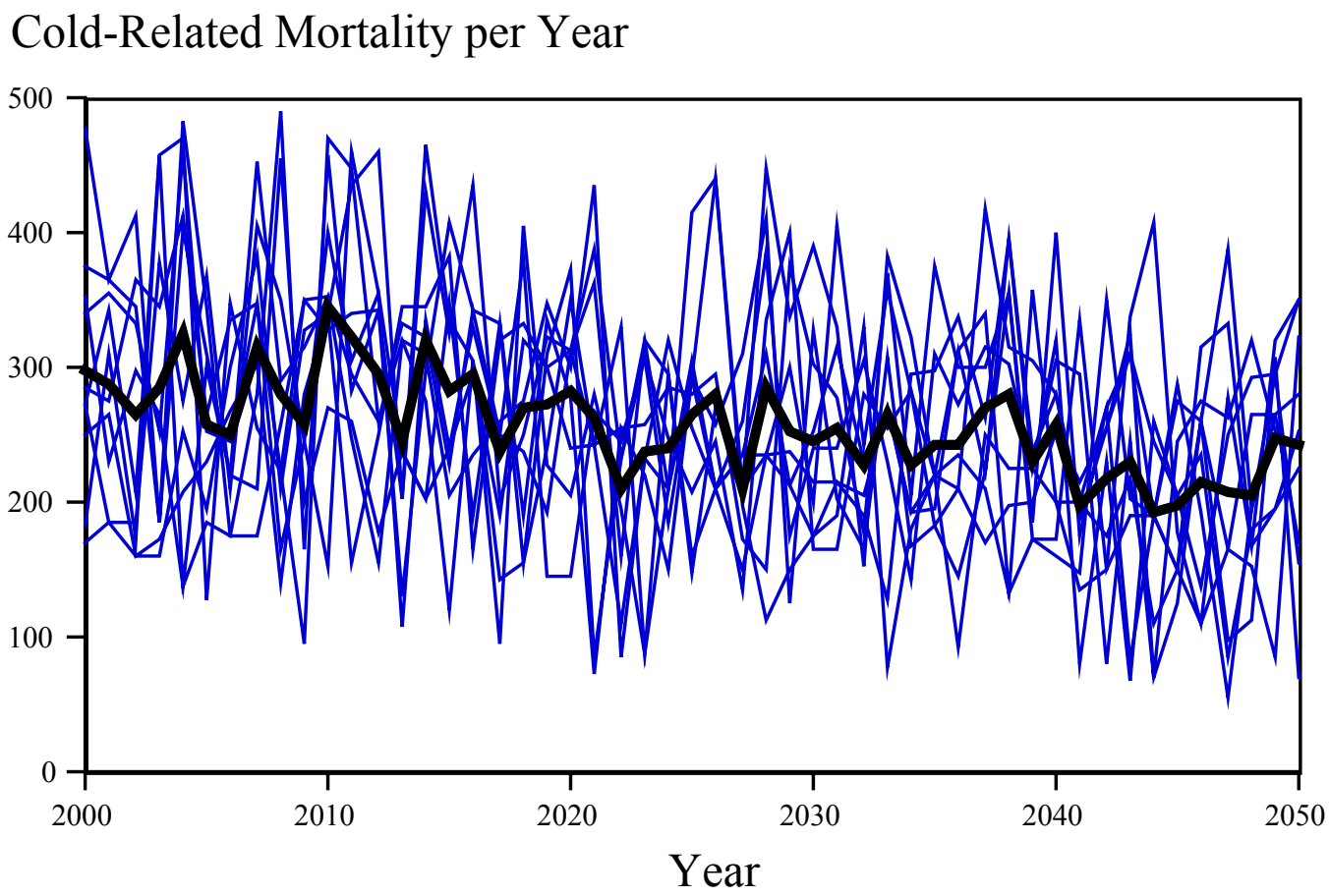
Temperature - Health Relationships



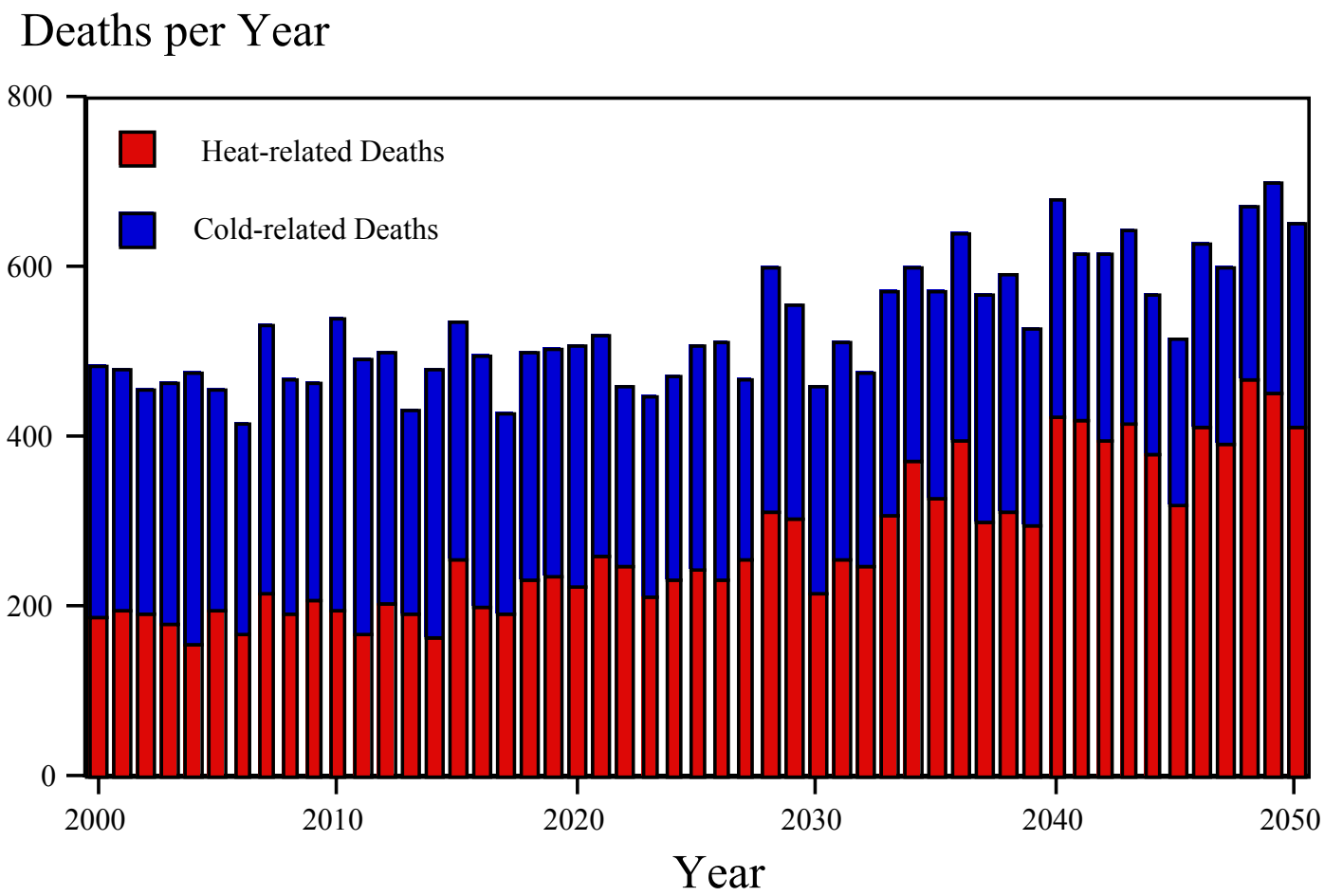
10 Bootstrap Projections of Heat-related Mortality



10 Bootstrap Projections of Cold-related Mortality



Projections of Temperature-related Mortality



Six Challenges for Research, Education and Decision Making

- Avoid Environmental Ambulance Chasing
- Foster Diversity of Problem Solving Approaches
- Leverage Interdependencies among Infrastructures and Institutions
- Implement Forward-looking Design Criteria and Standards
- Get Multiple Bangs for the Buck
- Promote International Collaboration